

# ***Morus* sp. cultivation in Natura 2000 sites: environmental constraints and considerations**

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## **Abstract**

*Morus* sp. is a versatile resource with diverse benefits; however, its cultivation may entail negative environmental impacts. Environmental legislation imposes constraints to mitigate these effects. The current study presents a three-tier classification approach to assess the severity of constraints imposed by environmental legislation on *Morus* sp. cultivation. The approach is tested in a case study area located in BG0000254 Besaparski vazvishenita, Bratsigovo Municipality, Bulgaria. Approximately 23.6% of this area is under strict protection, thereby prohibiting cultivation. In about 21.3% of the area, *Morus* sp. cultivation is feasible but most probably an Appropriate Assessment procedure will be required to ensure nonsignificant negative impact. In the remaining 56.4% of the area, notification/screening is necessary, with the likelihood of not requiring a full Appropriate Assessment procedure. Thus, despite a significant portion being under strict protection, there remains potential for *Morus* sp. cultivation within the study area, albeit with varying procedural complexities.

The proposed constraints classification approach can inform land use planning, facilitating informed decision-making in site selection not only for *Morus* sp. but for all types of permanent crops.

## **Keywords**

constraints, cultivation, *Morus* sp., Natura 2000

## **Introduction**

*Morus* sp., commonly known as mulberry, encompasses species with diverse biological, chemical, and horticultural characteristics. The genus has a wide geographical distribution, high morphological variability, long history of domestication and high rate of natural hybridization among the species (Vijayan et al., 2011).



The rich phytochemical composition, beneficial effects on human health, fast growth, adaptability and different applications in agriculture and urban planning make *Morus* sp. a valuable resource for addressing various societal needs. *Morus* sp. are widely distributed in various regions, suggesting their adaptability and potential for cultivation in different climates suggesting their potential for cultivation and resilience in the face of climate change (Temviriyankul et al., 2020). The genus is not native to Bulgaria. Alexandrov, Dobrev (2011) have assessed the services and values of *M. alba* and *M. nigra* in the country, including drought, salt and smoke resistance, soil and water conservation (including watershed management), soil fertility and aesthetic values.

Despite the proven benefits of *Morus* sp. cultivation, growing mulberries can have negative effects on the environment and biodiversity. Monoculture plantations may lead to the loss of natural habitats, habitats of species, plant and animal diversity, as well as damage to water resources. A potential risk of planting non-native species is the uncontrolled dispersion, including in natural habitats. Species of genus *Morus* are considered invasive in North America, South America and Southern Africa (Richardson, Rejmánek (2011); GISD (2024)). The genus is not considered invasive in Bulgaria (EEA (2024); Petrova et al. (2013)). Blitek et al. (2022) surveyed the distribution of *Morus alba* in Wrocław (Poland) and found low number of seedlings reaching maturity. This led to the conclusion that the species does not show signs of expansion. However, depending on the region, the period between the introduction of a species and its excessive expansion can vary considerably, and the invasive influence of trees and shrubs is difficult to assess on the basis of distribution alone. The authors recommend *Morus alba* for planting, but with a continuous monitoring of its current and future development.

Additional issues may arise from use of pesticides and chemicals used in agriculture to control diseases and pests. To prevent such negative impacts, the cultivation of *Morus* sp. needs to adhere to certain constraints, including legal ones. A number of constraints are related to the protection of natural ecosystems and biodiversity. In Bulgaria, potential constraints to *Morus* sp. cultivation, triggered by biodiversity protection, may arise if activities are planned in sites from the National Ecological Network (NEN). This network is developed in accordance with the Biodiversity Low (2002) and consists of sites that are part of the European ecological network Natura 2000, and protected territories designated in accordance with the Protected Territories Low (1998). Priority is given to including CORINE sites, Ramsar sites, important plant areas, and ornithologically important areas in the network. According to Biodiversity Low (2002), the objectives of NEN are long-term conservation of biological, geological and landscape diversity; provision of sufficient of size and quality areas for breeding, feeding and resting, including migration, moulting and wintering wildlife; creation of conditions for genetic exchange between separate populations and species; participation of Bulgaria in European and global environmental networks; limitation of the negative anthropogenic impact on protected areas.

According to the Protected Territories Low (1998), protected territories fall into six categories: reserves, national parks, natural monuments, managed nature



reserves, nature parks, and protected sites. By the end of 2021, the number of protected territories in Bulgaria is 1025, covering a total area of 583625.9 ha, or 5.27% of the country's territory. The restrictions vary depending on the category of the protected territory and are described in each one's regimes. By the end of 2021, the Bulgarian Council of Ministers had adopted 353 Natura 2000 sites within the Natura 2000 ecological network, covering a total of 34.9% of the country's territory. Sites are designated via Order of Designation, containing information about the site, its subject, objectives, and the prohibitions within it. For each site, a Standard Data Form (SDF) is issued containing information about the site and its subject to protection. With the exception of the prohibitions listed in the Order of Designation, activities within Natura 2000 sites are not prohibited, but an Appropriate Assessment procedure must be followed in accordance with the Biodiversity Low (2002) and the Ordinance on the conditions and procedures for conducting appropriate assessment of plans, programs, projects, and investment proposals with the subject and aims of conservation of protected sites (AA Ordinance) (2007), to demonstrate the lack of significant negative impacts. According to the Biodiversity Low (2002), plans, programs, projects, and investment proposals that are not directly related to, or necessary for the management of Natura 2000 sites, and that individually or in interaction with other plans, programs, projects, or investment proposals may have a significant negative impact on the Natura 2000 sites are subject to an Appropriate Assessment procedure. According to the AA Ordinance (2007), plans, programs, investment proposals, or their modifications or expansions, entirely or partially falling within the boundaries of protected sites and related to a change in the purpose and/or manner of permanent land use, are subject to an Appropriate Assessment.

Other nature conservation restrictions stem from the necessity to preserve permanently grassed areas. According to Ordinance No 105 (2006), the Ministry of Agriculture and Food creates a specialized layer "Permanently Grassed Areas" in the System for Identification of Agricultural Parcels. The "Permanently Grassed Areas" layer is normatively defined in the Law on Support for Agricultural Producers (1998), which introduces a prohibition on the conversion and plowing up by farmers of permanently grassed areas included in the layer. The Minister of Agriculture and Food may, by exception, authorize, by order, the conversion into another type of agricultural land or the plowing up of permanently grassed areas outside the scope of Natura 2000 sites, provided that another area on the same farm is converted into permanently grassed areas accordingly. Areas within Natura 2000 are not subject to such substitution.

Restrictions to activities in forest areas arise from the Forestry Low (1997), which regulates the management, reproduction, use, and conservation of forests in Bulgaria. Waterbodies also represent restrictions to the cultivation of *Morus* sp. All the described restrictions are added to existing ones arising from urbanization, infrastructure, cultural heritage, land use, etc. The identification and compliance with the various existing constraints is a crucial step in the planning of *Morus* sp. cultivation.



The aim of this article is to develop a classification approach for ranking the severity of constraints imposed by environmental legislation to *Morus* sp. cultivation within Natura 2000 sites, facilitating informed decision-making and land use planning, and test it in a selected case study area.

The selected case study area falls within Bratsigovo Municipality. The municipality is located in the western part of Bulgaria, within the administrative region of Pazardzhik. The territory of the municipality covers 229 km<sup>2</sup>. The largest proportion of its territory is occupied by forested areas, covering 120203 ha (52.28% compared to the national average of 35%). Agricultural land comes second, covering 99067 ha (43.09% compared to the national average of 58%). Populated areas account for 2.45% or 5.64 ha. Water bodies occupy 1.75% of the municipality's territory, while areas for transportation and infrastructure cover 0.43% (General Development Plan of Bratsigovo Municipality (GDP), 2017). Plant cultivation in the municipality is limited due to soil and climatic conditions and the mountainous to semi-mountainous terrain. However, there are opportunities for the cultivation of perennial crops and vineyards, as well as the traditional cultivation of potatoes in the region (GDP, 2017). As part of its implementation program for the Integrated Regional Operational Program of Bratsigovo Municipality (2021), under Priority 1 – Strengthening the municipality's competitive position, fostering sustainable, innovative, intelligent economic growth based on local resources, improving the business environment, and stimulating entrepreneurship, is outlined Measure 1.3 Development of modern, sustainable, and diversified agriculture. One of the activities under this measure is the increase of perennial plantations in the municipality.

According to the Information system for protected sites from the ecological network Natura 2000 (MOEW), within the municipality's territory partially fall two Natura 2000 sites designated for the conservation of wild birds (BG0002057 Besaparski ridove and BG0002063 Zapadni Rodopi), and two Natura 2000 sites designated for the conservation of natural habitats and wild flora and fauna (BG0000254 Besaparski vazvisheniya and BG0001030 Rodopi – Zapadni). Furthermore, 8 protected territories under Protected Territories Low (1998) fall within the municipality (either wholly or partially). As a case study area for identification and assessment of the constraints is selected the part of BG0000254 Besaparski vazvisheniya, falling within the borders of Bratsigovo Municipality.

## Materials and methods

### Case study area

The case study area covers the part of BG0000254 Besaparski vazvisheniya falling within the boundaries of Bratsigovo Municipality. The site has a total area of 6743.06 ha. Within the municipality of Bratsigovo, 2753.25 ha fall under this designation. This area represents 40.8% of the site's territory and 12% of the territory of the municipality (Figure 1).



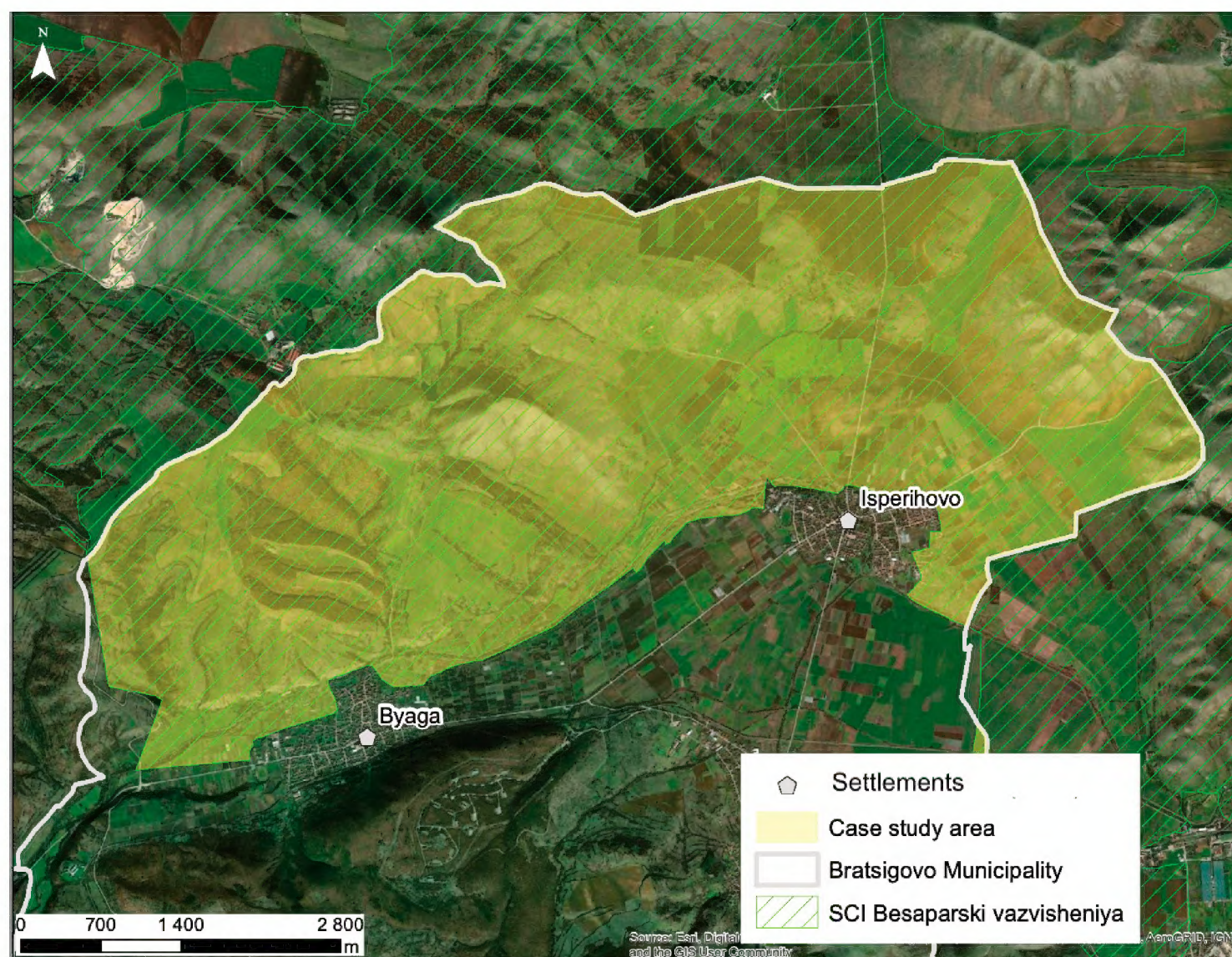


Figure 1. Case study area

## Methods

The analysis of the constraints triggered by environmental legislation to the cultivation of *Morus* sp. in the case study area is made within a GIS environment, using the ArcGIS 10 software.

The datasets used to delineate the constraints are listed in Table 1.

Based on the analysis of the relevant constraints, a three-tier classification approach was developed and employed to rank the case study area according to existing constraints related to environmental legislation.

Tier 1: Major constraints - Cultivation of *Morus* sp. is not possible due to significant constraints, including:

- Protected territories designated in accordance with the Protected Territories Law (1998);
- Restricted areas according to the Order of Designation of a Natura 2000 sites;
- Permanent grasslands within Natura 2000 sites;
- Forested areas;
- Water bodies.



**Table 1.** GIS data used for the delineation of the constraints

Data used for the determination of the geometry
<ul style="list-style-type: none"><li>• Borders of the Natura 2000 sites, available at the Information system for protected areas from the ecological network Natura 2000 <a href="https://natura2000.egov.bg/EsriBg.Natura.Public.Web.App/Home/Documents">https://natura2000.egov.bg/EsriBg.Natura.Public.Web.App/Home/Documents</a></li><li>• Borders of the protected territories (designated in accordance with Protected Territories Law (1998)), available at the website of the EEA <a href="https://eea.government.bg/zpo/bg/index_download.jsp">https://eea.government.bg/zpo/bg/index_download.jsp</a></li><li>• GIS database of the project: “Mapping and determination of the conservation status of natural habitats and species - Phase I”, Ministry of Environment and Water (MOEW, 2013), available at the Information system for protected areas from the ecological network Natura 2000 <a href="https://natura2000.egov.bg/EsriBg.Natura.Public.Web.App/Home/Documents">https://natura2000.egov.bg/EsriBg.Natura.Public.Web.App/Home/Documents</a></li><li>• GIS Database from Japan International Cooperation Agency (JICA), (JICA 2006);</li><li>• General development plan of Bratsigovo Municipality (GDP) (2017) <a href="https://drive.google.com/drive/folders/1YqPyYNLSOK5op2GslwiljOBZAS-ck_F4">https://drive.google.com/drive/folders/1YqPyYNLSOK5op2GslwiljOBZAS-ck_F4</a></li><li>• GIS layer “Permanently Grassed Areas” available in the System for Identification of Agricultural Parcels <a href="https://www.mzh.government.bg/bg/politiki-i-programi/programi-za-finansirane/direktni-plashaniya/identifikaciya-na-zemedelski-parceli/">https://www.mzh.government.bg/bg/politiki-i-programi/programi-za-finansirane/direktni-plashaniya/identifikaciya-na-zemedelski-parceli/</a></li></ul>

Tier 2: Major Constraints - Cultivation of *Morus* sp. is potentially possible in these areas under specific conditions and only after a justification for nonsignificant negative impact (via full Appropriate Assessment procedure). These areas encompass:

- Natural habitats protected within Natura 2000 sites;
- Habitats of plant species subject to protection in Natura 2000 sites;
- Habitats of animal species subject to protection in Natura 2000 sites (important / optimal).

Tier 3: Minor Constraints - Cultivation of *Morus* sp. is likely possible in these areas, however nonsignificant negative impact justification via Appropriate Assessment procedure is required. In these cases, it is likely that a full procedure will be not necessary, only notification/screening phase. These areas include:

- Areas within Natura 2000 sites that are not natural habitats or habitats of species, subject to protection;
- Areas within Natura 2000 sites that are habitats of species, subject to protection, but the cultivation of *Morus* sp. does not have the potential to significantly affect them;
- Suboptimal habitats of protected species within Natura 2000 sites.

The habitats of species subject to protection are assessed case by case. They may trigger Tier 1, 2 or 3, depending on the specifics of the site and the species.



## Results and discussion

Subject to protection within BG0000254 Besaparski vazvisheniya are seven types of natural habitats (SDF, 2021; Order of Designation, 2021):

- 5210 Shrubs with *Juniperus* spp.;
- 6110\* Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi;
- 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (\* important orchid sites);
- 6220\* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea;
- 62A0 Eastern sub-mediterranean dry grasslands (*Scorzoneratalia villosae*);
- 91AA\* Eastern pubescent oak woods;
- 91M0 Pannonian-Balkan turkey oak –sessile oak forests.

In the site's SDF (2021), 29 species are included as conservation subjects, 8 of which have a population assessment "D". In the Order of Designation (2021), 6 species of mammals, 4 species of reptiles, 3 species of amphibians, 2 species of fish, 6 species of invertebrates, and one plant are included. In this analysis, the species from the Order of Designation (2021) are considered, as the species with an assessment "D" are not evaluated in the Appropriate Assessment procedure, and therefore their habitats do not trigger constraints to *Morus* sp. cultivation. The species from the Order of Declaration (2021) are:

- Mammals: marbled polecat (*Vormela peregusna*), Eurasian otter (*Lutra lutra*), european souslik (*Spermophilus citellus*), greater horseshoe bat (*Rhinolophus ferrumequinum*), lesser horseshoe bat (*Rhinolophus hipposideros*), long-fingered bat (*Myotis capaccinii*);
- Amphibians and reptiles – European fire-bellied toad (*Bombina bombina*), yellow-bellied toad (*Bombina variegata*), southern crested newt (*Triturus karelinii*), blotched snake (*Elaphe sauromates*), European pond turtle (*Emys orbicularis*), Hermann's tortoise (*Testudo hermanni*), Greek tortoise (*Testudo graeca*);
- Fish – spined loach (*Cobitis taenia*), Thracian barbel (*Barbus cyclolepis*);
- Invertebrates – stag beetle (*Lucanus cervus*), great capricorn beetle (*Cerambyx cerdo*), long-horned beetle (*Morimus funereus*), wrinkled darkling beetle (*Probatiscus subrugosus*), large copper (*Lycaena dispar*), jersey tiger moth (*Euplagia (Callimorpha) quadripunctaria*);
- Plants – *Himantoglossum caprinum*.

Two of the prohibitions of the Order of Designation (2021), trigger constraints to the cultivation of *Morus* sp. These are:

Prohibition 8.4. Changing the permanent use, destruction, afforestation, and conversion into permanent plantations of meadows, pastures, and marshes when using agricultural lands as such is prohibited.

Prohibition 8.5. Clearing and afforestation of glades, clearings, and other non-afforested forest areas within the boundaries of non-forest natural habitats subject to



conservation are prohibited except in cases of proven necessity for protection against erosion and torrents, as well as in cases of implementation of permissible plans, programs, projects, or investment proposals approved under the environmental legislation.

The main water artery passing through the municipality is the Stara reka River. This river and several of its tributaries traverse the territory of BG0000254 Besaparski vazvisheniya. Within the case study area, there are 5 micro-dams and two lakes, with a total area of 15.45 ha. These areas trigger Tier 1 constraints, and the cultivation of *Morus* sp. is not possible.

In the case study area, there are 250.18 ha of forested areas (GDP, 2017). They also trigger Tier 1 constraints. The forests under the GDP (2017) largely overlap with forest habitats subject to protection (MOEW, 2013), but about 39 ha of forest habitats, subject to protection, are not included in this area (about 4 ha of 91M0 and 35 ha of 91AA).

The area of meadows and pastures in the case study area (triggering Tier 1 constraints due to the restrictions of the site's Order of Designation (2021)) is 309.27 ha. They are almost entirely overlapped by permanently grassed areas, which trigger Tier 1 constraints, however permanently grassed areas trigger an additional 8 ha of Tier 1 constraints. Taking into account the overlap, the total area affected by Tier 1 constraints triggered by grasslands is 317.27 ha.

One of the protected territories in Bratsigovo Municipality falls within the boundaries of BG0000254 Besaparski vazvisheniya. This is Protected Locality (PL) Nahodishte na atinska merendera, Isparihovo, with an area of 37.48 ha. In the PL are prohibited changing the land use and permanent land use methods (which is pastures and meadows) and importation of non-native species. The PL triggers Tier 1 constraints and cultivation of *Morus* sp. in its territory is not possible. It completely overlaps with permanently grassed areas and it is covered with pastures and meadows, so its presence does not increase the area of Tier 1 constraints.

The analysis of Tier 1 constraints, triggered by forests, pastures and meadows, permanently grassed areas, waterbodies and protected territories (taking into account the overlapping) showed that, these constraints cover a total of 612.9 ha in the case study area, or about 22.3% of it (Figure 2).

Non-forest habitats, subject to protection in BG0000254 Besaparski vazvisheniya are 5210, 6110, 6210 and 62A0. They trigger Tier 2 constraints, as activities on their territory are not strictly forbidden but an Appropriate Assessment procedure may be needed to justify the lack of significant negative impact. Part of the areas covered with these habitat types are triggering Tier 1 constraints due to the presence of pastures, permanent grasslands, forest lands or protected territories. The total area of habitats, subject to protection triggering Tier 2 constraints that do not overlap with Tier 1 territories is 581.8 ha, including habitat 5210 – 1.3 ha, 6110 – 22 ha, 6210 – 255.17 ha, and 62A0 – 303.3 ha (Figure 3).

Habitats of species cover nearly the entire area of the site in Bratsigovo Municipality. The constraints triggered by each species depend on its ecological specifics and habitat preferences.



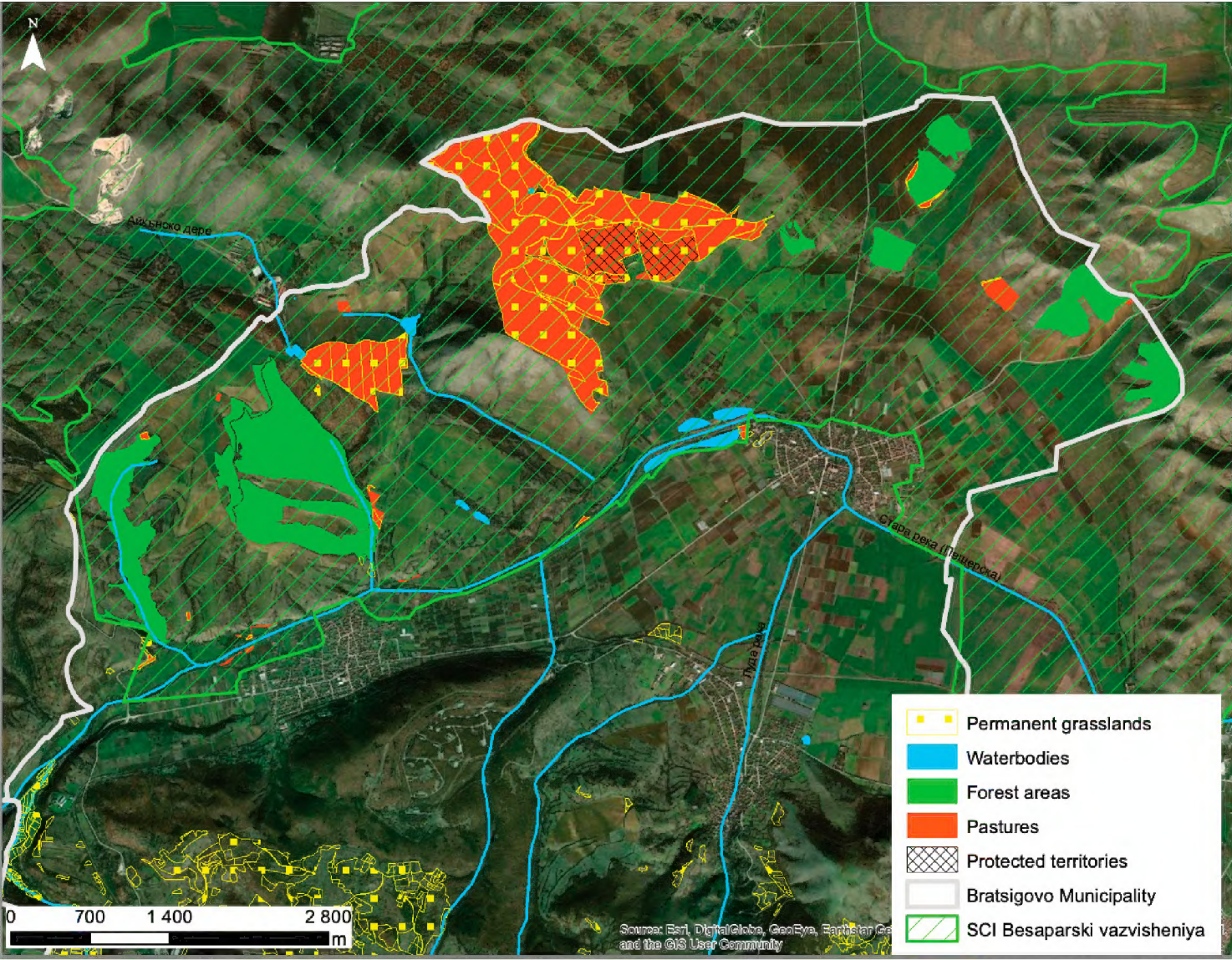


Figure 2. Land cover, triggering Tier 1 constraints

*Vormela peregusna*: The species inhabits open habitats such as meadows, pastures, steppes, semi-deserts, rocky terrains, fallow lands, including river valleys, dry valleys, and canyons. Preferred sites include those with large colonial rodents (Spasov, Spiridonov, 2011). These habitats generally trigger Tier 1 constraints as they include pastures and meadows. The species is also found in cultivated areas, orchards, outskirts of settlements (Gorsuch, Lariviere 2005), so the cultivation of *Morus* sp. will not result in complete loss of habitat. Habitats of the species outside of Tier 1 sites (triggered by permanently grassed areas, pastures and meadows) are considered Tier 3.

*Lutra lutra*: Habitats of the species in the site consist of flowing and standing water bodies and their adjacent riparian zones. The species favours wooded banks (Georgiev, 2008). Water bodies and forest vegetation in the case study area are considered Tier 1 constraints, meaning this species does not trigger additional constraints.

*Spermophilus citellus*: The optimal habitat of the species are grasslands and meadows, assessed as triggering Tier 1 constraint due to permanently grassed areas and the prohibitions from the site’s Order of Designation (2011). The species does not inhabit cultivated areas, although it enters them for feeding (Red Data Book, 2011). The habitats of the species outside of the Tier 1 sites are considered Tier 3.

*Rhinolophus ferrumequinum*, *Rhinolophus hipposideros*, *Myotis capaccinii*: The cultivation of *Morus* sp. does not have the potential to damage old-growth forests



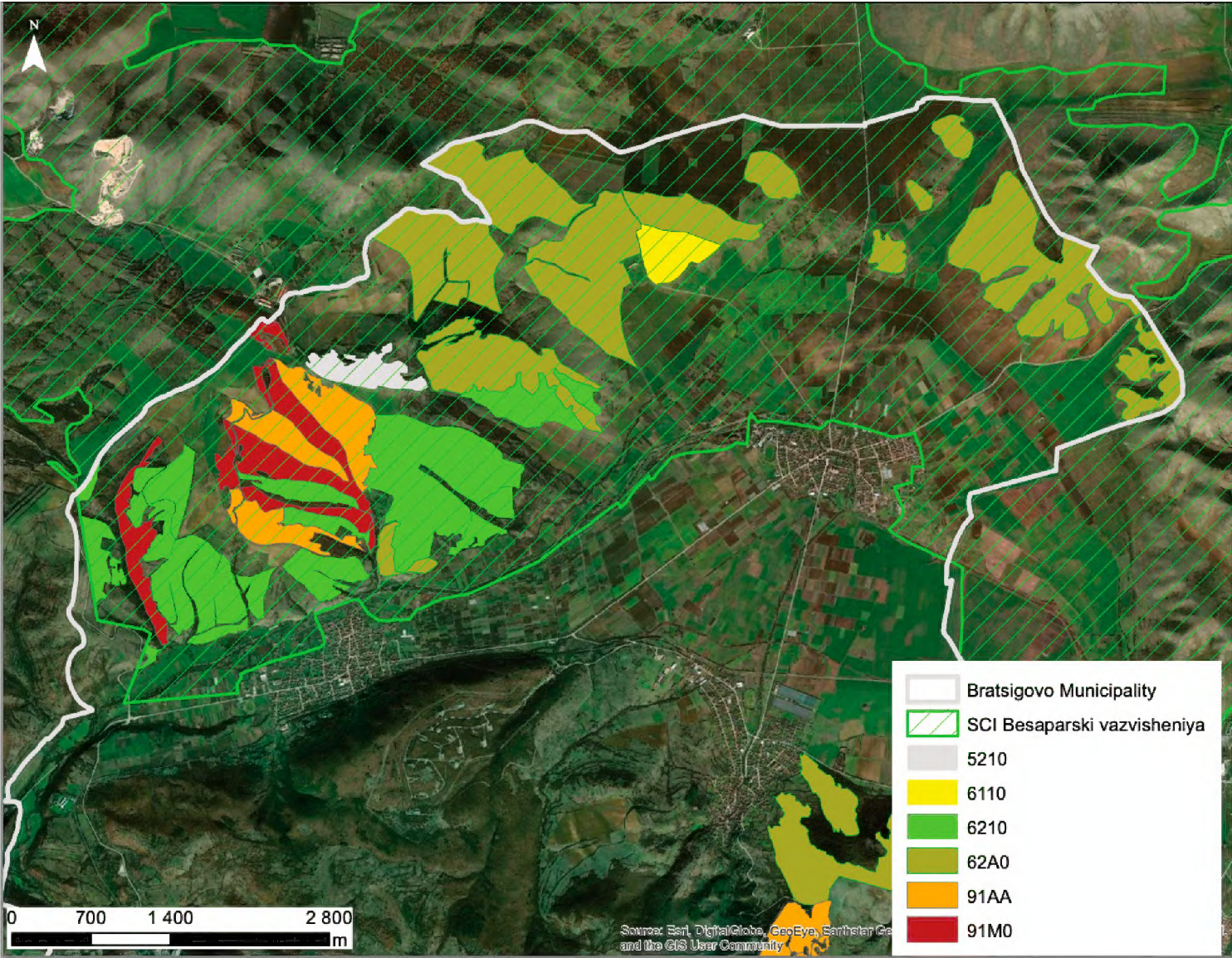


Figure 3. Habitats, subject to protection

with hollow trees or underground/synanthropic shelters, hence it does not have the potential to cause significant negative impact on the populations and habitats of bats. The constraints triggered by feeding habitats of bats are assessed as Tier 3.

*Bombina bombina*: There are no potential habitats in the case study area (MOEW, 2013)

*Bombina variegata*: The species inhabits natural and artificial lakes, rivers, ditches, canals, temporary ponds, and flooded tracks. It prefers ponds with abundant vegetation (Biserkov, 2007). Constraints in the species' habitats are assessed as Tier 3, as the cultivation of *Morus* sp. does not have the potential to damage water bodies, hence it does not have the potential to cause significant negative impact.

*Triturus karelinii*: The species reproduces and hibernates in stagnant water basins such as lakes, marshes, reservoirs, etc. (Beshkov, Nanev, 2002; Tzankov et al., 2014). During the terrestrial phase, it inhabits areas around the aquatic habitat but can also be found at a distance from water basins (Stojanov et al. 2011). Constraints in the species' habitats (outside those already identified as Tier 1) are assessed as Tier 3, as the cultivation of *Morus* sp. does not have the potential to damage water bodies, hence it does not have the potential to cause significant negative impact.

*Elaphe sauromates*: The species inhabits open spaces covered with grass vegetation, pastures, scrubland areas, scattered broad-leaved forests, and sometimes wet-



lands along rivers, marshes, and water bodies (Biserkov, 2007). Outside of the areas designated as Tier 1 habitats, the habitats of the species are suboptimal. Areas where *Morus* sp. is cultivated also provide a suboptimal habitat for the species. The habitats of the species outside of the Tier 1 sites are considered Tier 3.

**Tortoises:** *Testudo graeca* is found in various types of habitats but prefers open areas with grass and shrub vegetation, forest edges, clearings, scattered broad-leaved forests (especially oak). *Testudo hermanni* inhabits hilly areas with shrubs and low-statured forests. It is more closely associated with the forest compared to *Testudo graeca* (Bekchiev et al., 2017). Outside of the areas designated as Tier 1 habitats, the habitats of both species are suboptimal. The cultivation of *Morus* sp. will also provide a suboptimal habitat for the species. The habitats of both species outside of the Tier 1 sites are considered Tier 3.

***Emys orbicularis*:** Habitats of the species in the case study area are the rivers, assessed as Tier 1 constraint, so this species does not trigger additional constraints.

***Cobitis taenia*, *Barbus cyclolepis*:** Habitats of the fish in the site are the rivers (for both species), and stagnant waterbodies (for *Cobitis taenia*), assessed as Tier 1 constraint, so the fish do not trigger additional constraints.

***Lucanus cervus*, *Cerambyx cerdo*, *Morimus funereus*:** These species inhabit forests with specific characteristics (species composition, age, availability of dead trees) (Zingstra et al., 2009). Forests are assessed as Tier 1 constraint, so these species do not trigger additional constraints.

***Probatiscus subrugosus*:** Inhabits steppe and sub-Mediterranean grassland communities, often mixed with shrubs, and less frequently, derivative steppe and meadow vegetation (Bekchiev et al., 2018). Those habitats are assessed as triggering Tier 1 constraint due to permanently grassed areas and the prohibitions from the site's Order of Designation (2011). The habitats of the species outside of the Tier 1 sites are considered Tier 3.

***Lycaena dispar*:** Species, associated with wetland habitats (e.g., wet meadows, riparian zones, around streams and lakes) where the larval host plants are present (Beshkov, 2011; 2014). These habitats are assessed as triggering Tier 1 constraints due to the presence of water bodies, permanently grassed areas, and prohibitions from the designation order. The habitats of the species outside of the Tier 1 sites are considered Tier 3.

***Euplagia quadripunctaria*:** This species is associated with broad-leaved forests, although in Bulgaria it can be found in various habitats where the larval host plants are present (Bekchiev et al., 2017). Forests trigger Tier 1 constraints, and the remaining territories, which according to MOEW's database, are potential habitat of the species, trigger Tier 3 constraints as they are suboptimal.

***Himantoglossum caprinum*:** Occurs in open, sunny areas, on lightly used pastures, among shrubs, and in forest clearings within light broad-leaved forests. It is one of the orchid species in habitats 6210\* and 91AA\*. In the case study area, the potential habitat of the species does not coincide with the natural habitats subject to protection or with other areas triggering constraints. The habitat of the species (5.7 ha) is considered to trigger Tier 2 constraints.



The analysis of the habitat preferences of the species, subject to protection in the SCI, and the available GIS data of their distribution (MOEW, 2013) showed that most of the species trigger constraints in areas, where constraints are already identified due to the presence of permanently grassed areas, habitats, subject to protection, forests, water bodies. Only the distribution of *Himantoglossum caprinum* does not overlap with the identified constraints and triggers additional 5.7 ha Tier 2 constraints.

At 1552.85 ha, or 56,4% of the case study area, none of the analysed Tier 1 and Tier 2 constraints were identified (Figure 4). The area is, however, part of a Natura 2000 site, which triggers Tier 3 constraints. If *Morus* sp. cultivation is planned in this area, notification/screening as per the AA Ordinance will be necessary, but it is likely that no entire Appropriate Assessment procedure will be needed to justify the lack of significant negative impact.

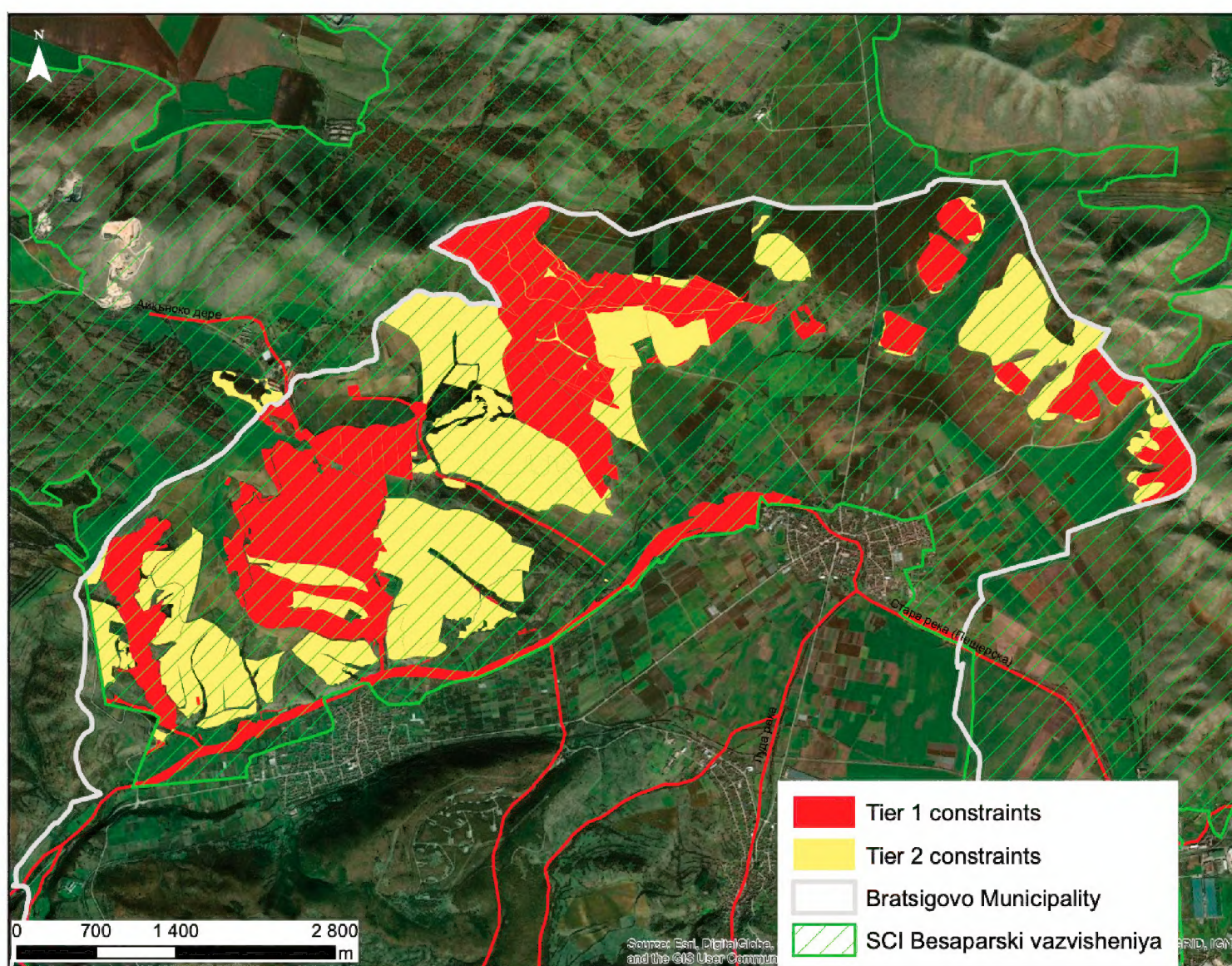
## Conclusion

Despite the recognized ecological benefits of cultivating *Morus* sp., it may lead to potential adverse impacts on biodiversity, necessitating careful consideration. Environmental constraints, stemming from legislation are related to the protection of permanently grassed areas, Natura 2000, protected territories, and forests. Some constraints render certain areas unsuitable for *Morus* sp. cultivation, while others necessitate adherence to specific procedures to demonstrate lack of significant impact.

The analysis reveals that the entire case study area (BG0000254 Besaparski vazvisheniya, located in Bratsigovo Municipality) is subject to constraints dictated by environmental legislation. However, these constraints vary in their stringency. Tier 1 constraints, triggered by forests, pastures and meadows, permanently grassed areas, waterbodies and protected territories (taking into account the overlapping) cover a total of 612.9 ha in the case study area, or about 23.6% of it. This area is under strict protection, precluding cultivation. The total area of Tier 2 constraints, triggered by non-forest habitats, subject to protection and habitats of *Himantoglossum caprinum* outside of the areas triggering Tier 1 constraints is 587.5 ha, or about 21.3% of the case study area. If cultivation of *Morus* sp. is planned in these areas it will most likely require an Appropriate Assessment procedure to ensure the lack of significant negative impacts. The remaining 1552.85 ha (56.4%) of the area (suboptimal habitats of species, subject to protection) trigger Tier 3 constraints. In these areas notification/screening as per the AA Ordinance will be necessary, but it is likely that no entire Appropriate Assessment procedure will be needed to justify the lack of significant negative impact. Thus, despite a considerable portion being under strict protection, there is still potential for *Morus* sp. cultivation within the study area, albeit with differing levels of procedural complexity.

The proposed and tested classification approach for ranking the severity of constraints imposed by environmental legislation to *Morus* sp. cultivation within Natura





**Figure 4.** Tier 1 and Tier 2 constraints

2000 sites can be used in land use planning, to facilitate informed decision-making in selection of sites for cultivation not only for *Morus* sp., but for all types of permanent crops.

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